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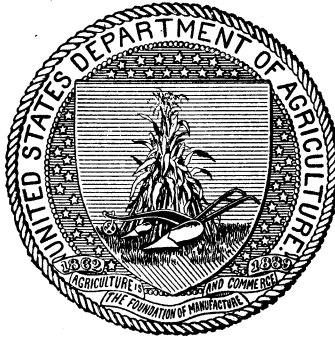
FOREST NURSERIES FOR SCHOOLS.

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U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS,
Washington, D. C., August 24, 1910.

SIR: I have the honor to transmit herewith a manuscript entitled "Forest Nurseries for Schools," which was prepared by Walter M. Moore and Edwin R. Jackson, of the Forest Service, under the direction of Dick J. Crosby, specialist in agricultural education of this Office, and has been submitted to this Office by the Forester for publication in the agricultural education series.

The suggestions made in this manuscript are particularly valuable to rural-school teachers, since they clearly describe a form of school-garden work or elementary agriculture which is applicable to all parts of the country, and which, if properly conducted, will be of greater permanent value to the communities served than almost any other form of school-garden work. I therefore recommend the publication of this manuscript as a Farmers' Bulletin.

Respectfully,

A. C. TRUE,
Director.

HON. JAMES WILSON,
Secretary of Agriculture.

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FOREST NURSERIES FOR SCHOOLS.

INTRODUCTION.

In recent years there has been evident a decided movement toward the introduction of nature study and elementary agriculture into the regular work of the public schools. One of the most popular and interesting features of this movement has been the school garden. The large number of schools, both rural and city, which have established gardens, and the volume of literature which has been contributed on this subject, attest the importance and success which the school garden has achieved in the educational world.

Hitherto most school gardens have been devoted exclusively to the growing of common garden vegetables and flowering plants, with here and there the introduction of new species as an additional incentive to interest. One of the chief difficulties encountered has been that most of the plants and vegetables suitable for cultivation and demonstration purposes required by the school work mature or reach their most interesting stages at a season when the school is ordinarily closed for vacation. Another thing which has tended to make much school-garden work somewhat unsatisfactory is that after the work is once done no visible, tangible results are evident, and apparently no lasting good is accomplished other than the instruction given and the knowledge of plant life which may have been acquired.

A school nursery for the propagation of forest trees offers an interesting variation from the usual type of gardening and at the same time overcomes the difficulties just mentioned. The crop of the forest nursery is one which does not disappear with the close of the season, but instead the young trees need only to be transferred from the nursery bed to some new location on lawns or school grounds to become permanent evidence of the work done and a lasting tribute to the school (fig. 1). Furthermore, this work of transplanting the trees is best done early in the spring when the school is in session and at its best so far as the interest of the pupils is concerned. In this way the forest nursery is even more adaptable to school use than is the ordinary garden.

NOTE.—A list giving the titles of all Farmers' Bulletins available for distribution will be sent free upon application to a Member of Congress or the Secretary of Agriculture.

A nursery on the lines laid down in this circular will not require any more labor and attention than a garden, if as much, with the possible exception that there is the added necessity of collecting and storing the tree seeds through the winter. However, if this is found impracticable, tree seeds may be purchased, just as vegetable seeds are, from dealers. The actual work of caring for the nursery is practically the same as that required for the care of the garden. The ground for the seed beds is prepared in the same manner, and the seedlings require about the same amount of attention that the vegetables do.



FIG. 1.—A school plantation on the grounds of the Moran Street School, Joliet, Ill. The trees were grown by the pupils in a nursery and set out by them on the school grounds.

On the other hand, the results will be much more enduring and valuable. Besides the opportunities afforded by the nursery for study and instruction, the trees which are successfully grown will, if wisely utilized, be a source of comfort, beauty, and even profit to the school or community for years.

The plan outlined in this bulletin is intended to furnish suggestions and directions by which a school may establish and care for a small nursery. It is realized that schools will seldom have the best kind of soil available, or be supplied with all the tools desirable to do this work with the best re-

sults. Consequently, the attempt is here made to give directions which will be applicable to schools with very limited resources.

It is intended, further, to make these plans usable over as wide a range of territory as possible. Certain localities, with unusual conditions of temperature or humidity, will undoubtedly face local problems which are not touched upon in this bulletin. In all such cases the Forest Service of the United States Department of Agriculture invites correspondence with regard to the difficulties encountered, and will gladly furnish advice and suggestions free of charge.

GENERAL SUGGESTIONS FOR THE SCHOOL NURSERY.

WHEN TO BEGIN PREPARATIONS.

The first work of preparation for the school nursery must usually be done in the autumn, when the ground should be broken and fertilized to make ready for spring planting. Most forest-tree seeds must be collected in the autumn and stored through the winter. Hence the school which plans to establish a nursery should begin to lay plans for it during the fall term in order to have everything in readiness for work the following spring.

EXTENT OF THE UNDERTAKING.

Work of this nature should never be undertaken on too large a scale. If too many seedlings are planted, the care of the nursery may prove so much of a burden that the students will find no pleasure in it, and when the trees are grown it will be hard to dispose of them without loss. Should the trees die, the natural inference on the part of the pupils would be that the work done by them in caring for the young trees was useless. This would defeat the purpose of the undertaking. It should therefore be the endeavor of each school to raise but a few trees per pupil, but to grow these successfully and to transplant all of them with the smallest possible loss to permanent sites on the school grounds or about the homes in the community for shelter, timber, or ornamental purposes. This aim must be impressed upon the pupils if the lesson of the value of forest trees is to be taught. If only one tree per pupil is grown, but every one safely transplanted to a permanent site where it may grow into usefulness and beauty, the work of the nursery will be infinitely more satisfactory than if hundreds of seedlings are produced and many of them allowed to perish.

COOPERATION BETWEEN SCHOOLS.

It will add greatly to the pupils' interest in the tree nurseries if schools located in different parts of the country exchange supplies of tree seeds. It is suggested, therefore, that each school endeavor to communicate with some other school situated in another locality, and by exchange secure some new varieties of tree seeds and introduce these new and unfamiliar trees into the community. It will be much more interesting for the pupils to watch the growth of a strange type of tree than merely to produce those with which every one is already familiar, and, should the experiment be successful, these new trees may be made to serve a useful purpose if they are awarded as prizes for faithful work done by individual pupils. Care must always be taken, however, not to experiment too much with trees which are not likely to thrive because of the climate or other local conditions.

The Forest Service of the United States Department of Agriculture will be glad to cooperate in this work by putting schools desiring to exchange supplies of tree seeds in communication with each other, and also by giving free advice as to desirable trees adapted to each locality.

THE CARE OF THE NURSERY DURING VACATIONS.

One of the most difficult problems which the school will have to solve will be how to care for the nursery during the summer vacation. It will not do to leave the young trees which were planted during the spring term to take care of themselves through the hot months of July and August until school opens again in September. Some means must be devised to protect and care for them during this time. Just how this will be accomplished depends largely upon the ingenuity of the teacher and upon local conditions.

It is evident that some sort of an organization on the part of the pupils whereby they shall voluntarily assume the duties of caring for the nursery is infinitely more desirable than any other plan, because it will insure the continued interest and attention of the school to its project. No definite outline of the exact form which this organization shall assume is possible in this bulletin, because of the varying conditions surrounding different schools; but there are certain things which it must accomplish in order to serve its purpose successfully. Provision must be made for the regular cultivation of the seedlings by hoeing and weeding once or twice each month, or oftener, during the summer. They must, as a rule, be watered with more or less frequency, depending upon the season. If the site of the seed bed is exposed to trespassers or to the depredations of animals, it must be protected by fencing. All this must be done thoroughly and without fail or nothing but disappointment will come of the undertaking, and the resulting discouragement will be worse than if nothing had been done.

How to accomplish these ends will be a problem which each school will have to work out for itself. Possibly one solution would be the organization of a "forestry club" composed of volunteer "forest rangers" whose duties shall be the protection and care of the trees, just as the government officers look after the trees of the National Forests. These clubs may be the means of doing much good through the interest which they arouse in general forestry, as well as through the practical benefit derived from the nursery itself. The clubs could also arrange for an exchange of supplies of tree seeds and even of nursery stock, thus doing exactly the same work that commercial nurseries undertake in supplying new varieties of trees suitable and desirable for the community.

COLLECTING TREE SEEDS.

KINDS OF SEEDS TO COLLECT.

In deciding what kinds of seeds to collect several things must be considered. Among them are:

(1) **What trees will grow in the locality?**—Only those trees should be raised in the school nursery which are suited to the local climate. For example, trees native to warm regions should not be planted in cold climates, nor trees which require much moisture in arid regions.

(2) **Are they difficult to grow? Do they require much care?**—Conifers, commonly known as evergreens, examples of which are the pines and spruces, are not recommended for school nurseries because of the constant care and attention which they require during the first season's growth. The common broadleaf trees are best for school growing, since most of them can be grown from seed with a minimum amount of attention.

(3) **Will the trees when grown serve any useful purpose?**—It should always be the aim of the school to serve the community. Trees should be selected for the nursery which are desirable for shade, fruit, or ornamentation, or which will produce fuel or timber if transplanted to the field or woodlot.

For these reasons it is usually well to collect the seeds of hardy species of broadleaf trees such as are common in the vicinity. Throughout the greater portion of the eastern United States maples, locusts, ashes, elms, oaks, basswood, hickories, walnut, cottonwood, boxelder, and yellow poplar are among the best for planting. In dry regions, such as the western parts of Nebraska, Kansas, Oklahoma, and Texas, trees must be selected which will resist drought. Black locust, green ash, osage orange, and Russian mulberry are especially suitable for this purpose. Nearly all the trees mentioned in this paragraph, as well as many others, such as magnolia, redbud, willow oak, and live oak, grow successfully in the Gulf States. In the Pacific Northwest, while some difficulty may be encountered in collecting seeds from native broadleaf trees, any of the group indicated as available for the eastern United States may be expected to thrive.

WHEN TO COLLECT THE SEEDS ^a

Most tree seeds mature in the fall, and must be gathered as soon as they ripen. The seeds of a few species, such as silver maple and elm, ripen late in the spring, and should be collected then and immediately planted, since they soon lose their vitality.

^a See planting table, p. 24.

HOW TO COLLECT THE SEEDS.

Tree seeds must be collected chiefly by hand picking. Certain classes of them, such as honey locust seeds, acorns, hickory nuts, walnuts, and butternuts, which fall readily with the wind and frost, may be gathered from the ground after they have fallen (figs. 2 and 3). The smaller, thin-coated seeds, like those of maples, boxelder, ashes, and elms should be picked from the tree by hand or collected from the ground as soon as they fall. Since the first seeds which fall are often sterile, care should be taken to collect only the fertile seeds

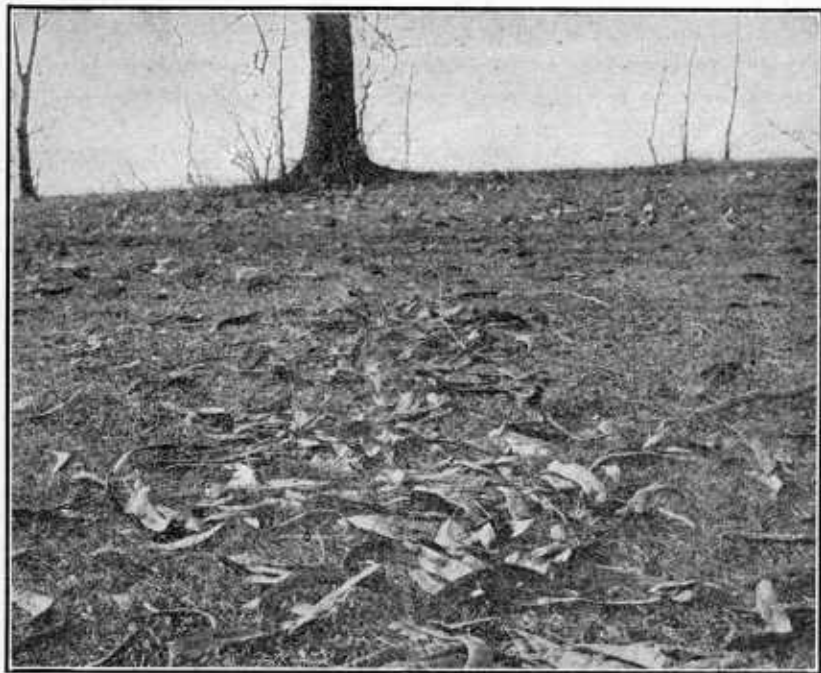


FIG. 2.—Honey-locust seed pods thrown down by the wind; this shows an opportunity for collecting seeds. Maryland.

which fall later. Methods of testing the germination of seeds are described elsewhere in this bulletin.

STORING THE SEEDS.**PRELIMINARY STORAGE.**

Thick hulls like those of the walnuts and hickory nuts should be dried and removed and the nuts spread out to dry in some cool, airy place. Pulpless pods, like those of black locust, may be dried and the seeds thrashed out with a flail. Acorns of bur oak and of several other species of oak which are difficult to remove from their cups

may well be left in storage with their cups attached. Nearly all seeds, including those divested of hull or pulp, should be dried slightly to prevent molding. Most tree seeds will be gathered a few weeks before it is time to store them permanently for the winter and should be spread out to dry during the interval. Nuts and acorns are best kept on a dirt floor. All should be examined frequently for signs of molding or of too much drying. If the seeds are molding they should be spread out to the air in thinner layers. If they are drying out too much it can be detected by cutting into the seeds and examining the kernels. Any shrinkage of the kernels will indicate a drying out, and this may be remedied by covering the seeds with clean sand or chaff.

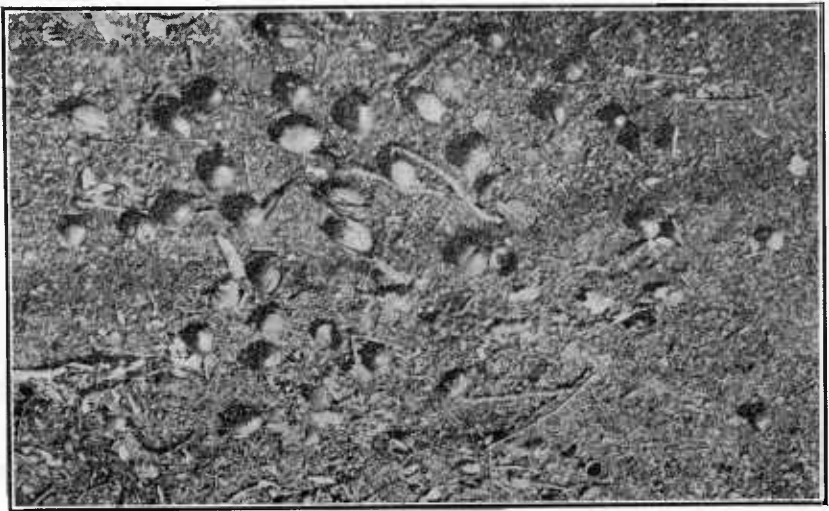


FIG. 3.—Chestnut-oak acorns exposed by a spring forest fire after lying on ground through winter; this shows the germination of several acorns the previous fall. Maryland.

PERMANENT STORAGE.

Acorns and other nuts are best stored during the winter by being buried in sand in a pit out of doors. This pit should be situated on raised ground so as to insure good drainage. The sides of the pit should be lined with boards or stones to keep out mice and squirrels. Cover the bottom with a layer of clean sand 2 or 3 inches deep. On this spread a layer of the nuts, then another layer of sand, and so on until all the seeds are stored. Then cover the whole with earth to a depth of from 4 to 6 inches. To prevent washing by rains, protect with a roof of boards or shingles. Any ordinary freezing which takes place during the winter will not damage the seeds, but rather help in opening the hard shells, thus insuring easy germination in the spring. Alternate freezing and thawing, however, may prove disastrous by destroying the vitality of the seeds. Seeds which have been frozen

should be planted immediately upon being removed from storage; a few hours' exposure may prevent the germination of many of them.

Another method of storing nuts is to mix them with a small quantity of dry chaff or straw and place them in a closely covered wooden box. This box should then be sunk into the ground to within a few inches of the top, and earth heaped up over it in a mound so as to protect its contents from frost and rains. It should be located on well-drained, elevated ground, so that it will be kept dry. This method of storage is simpler than the "stratification" method described in the preceding paragraph, and is likely, under ordinary conditions, to give just as satisfactory results. It is an especially desirable method in the Southern States, where, during mild winter weather, the nuts are likely to sprout if buried in layers of sand.

Seeds such as those of mulberry, catalpa, osage orange, and a few other trees may be kept in good condition by being placed in sacks hung in a cool, dry place away from danger of injury by rats and mice.

TESTING THE SEEDS.

A few weeks before time to plant the tree seeds it will be well to test them in order to see if they have retained their vitality while in storage. It is important that this be done, because of the disappointing results from sowing poor seeds.

CUTTING TEST.

Cut or break open a number of seeds and examine the kernels. If the seeds are in good condition for growing, the kernels will be plump and firm. If the kernels are withered, the seeds are unfit for planting, and should be discarded if a better supply can be obtained. If not, sow them more thickly than customary.

GERMINATION TEST.

The only accurate way to determine the quality of seeds is by a germination test. One way of making such a test, which can be employed conveniently in the case of the smaller seeds, is to count out a number of seeds and place them on a plate between two folds of moist blotting paper. The larger the number of seeds used, the more accurate will be the results of the test. The number used will of course depend on the supply at hand. If there is a plentiful supply of seeds, at least 100 should be used. On a slip of paper record the variety and number of seeds to be tested and the date. Place this record on the edge of the plate. Cover the whole with a pane of glass or another plate and set in a warm room (68° to 86° F.). Examine the seeds every twenty-four hours for two weeks, or as much longer as may be necessary. Keep the blotting paper moist, but not saturated. As soon as the seeds are well sprouted,

count out those which failed to germinate and from this determine the percentage of good seeds. If this percentage falls greatly below the standard for the particular species, as indicated in the table on page 24 of this bulletin, the seeds are of poor quality and should be rejected if another supply which is likely to give better results is available. If no others are to be had, plant the seeds more thickly in the rows than usual.

This method is a good one for small seeds, but is not applicable to acorns and large nuts, which would not, of course, be kept sufficiently moist by blotting paper to render germination certain. Such seeds may be tested in shallow boxes of moist sand, as described in Farmers' Bulletin 409, p. 14.

PREPARING THE SEED BED.

CHOOSING GROUND FOR THE NURSERY.

The bed in which the seeds are to be planted should be located on ground which is well drained. Level or gently sloping ground should be selected, for if it is too steep the soil may be washed away. If possible to secure it, ground which has been under cultivation for a year or more and which is well pulverized is better for the purpose than new ground. Sometimes the use of such ground can be secured on the edge of cultivated fields or gardens bordering on the school grounds.

Care should be taken to select a site away from the playground, where it will not be trampled upon. Unless the plat of ground to be used is protected properly in this respect, all work done may be useless.

If there is any choice to be had as to the kind of soil, a loose, sandy loam should be chosen rather than clay. In the majority of instances, however, schools will have to be content to put whatever soil is available into as good condition as possible under the circumstances. It is well to have the seed bed in a place where it will not be exposed too directly to the sun. If possible, it should have a partial protection by being situated to the east or north of a group of trees or buildings.

PREPARING THE SOIL.

Unless the land to be used is very rich and in good condition for the nursery, it is well to enrich it in the fall with well-rotted manure. The ground should then be plowed or spaded deeply and left without further preparation during the winter. In the spring, as soon as conditions will permit, it should again be worked over with a spade or plow and thoroughly pulverized by raking and harrowing, until all clods, stones, and rubbish have been removed. The better the condition of the soil the better the results will be. Too much attention can not be given to the preparation of the soil.

SIZE OF THE SEED BED AND ARRANGEMENT OF SEEDS..

The size of the plat of ground needed will, of course, depend upon the amount and variety of seeds to be sown. The seeds of the common broadleaf trees should be planted in rows. If only a few hundred are to be grown and the cultivation is to be done entirely by hand, the rows may be made only 18 inches apart. For greater quantities, when a hand cultivator is to be used, the rows had better be 2 feet or more apart.

The general arrangement of the seeds in the rows should be similar to that of peas grown for market. For example, if one square rod of ground is available, it can be marked off into 11 rows 18 inches apart, and each row will be 1 rod long and sufficient to produce about 50 seedlings. The capacity of the whole plat will then be about 550 trees. If it is desired, each row may be devoted to growing a single species of tree. In this case a stake should be driven at the end of each row distinctly labeled with the name of the seed planted in that particular row.

TREATMENT OF SEEDS PREPARATORY TO PLANTING.

In order to insure rapid sprouting and growth, some tree seeds with thick, hard shells need preliminary treatment before planting. Seeds with soft, thin coats, such as those of elm, basswood, and catalpa, need no treatment, but seeds like those of walnut and oak will germinate freely only when they have been buried in sand out of doors through the winter, as indicated in the paragraph on "Storing the seeds," and planted as soon as they are taken from the sand. The seeds of another class of trees, such as locusts and the coffee tree, require soaking in hot water in order to soften them enough to make sprouting possible. Immerse a quantity of the seeds in water not quite boiling and stir thoroughly for several minutes. Then allow the seeds to remain in the water as it cools for from twelve to twenty-four hours, stirring frequently in the meantime. At the end of this period the seeds should be ready for planting. It is very essential that seeds thus treated be planted without being allowed to dry out.

PLANTING THE SEEDS.**TIME FOR PLANTING.^a**

Early spring is ordinarily the best time to plant tree seeds, except those of species, such as silver maple and white elm, which mature in the late spring. It would be difficult to keep these seeds over until the next spring, through the hot months of the summer. Such seeds should, therefore, be planted as soon as they ripen. Certain other seeds, like those of basswood and yellow poplar, which ripen in the autumn, will retain their vitality only a few weeks. These seeds should be planted in the fall.

^a See planting table, p.24.

Generally speaking, however, nursery planting should be done as early in the spring as the ground can be worked. The exact time, of course, will vary in each case, according to the locality and the season—whether early or late. A good rule for spring sowing is to plant the tree seeds as soon as the soil and weather conditions become suitable for the planting of early vegetable seeds in the garden.

SOWING THE SEEDS IN THE SEED BED.

In general, fresh nuts and acorns of good quality should be planted 2 or 3 inches apart in the rows, while the seeds of ashes, maples, catalpas, elms, hackberry, and others in which the average of germination is between 45 and 75 per cent (see planting table, p. 24, column 4) should be spaced from $\frac{1}{2}$ inch to $1\frac{1}{2}$ inches apart. Seeds of abnormally low germinating power, such as those of the basswood and yellow poplar, should be sown three or four seeds deep in the rows. The depth of planting should never be greater than twice the average diameter of the seeds. There is some danger of planting the seeds too deep. It is better that they be planted too shallow than that they be buried too deeply in the soil.

CARE OF THE SEED BED AND SEEDLINGS.

CULTIVATION OF THE SEEDLINGS IN THE SEED BED.

As soon as the seedlings are well up, cultivation between the rows and weeding of the bed should begin. Small beds can be sufficiently cultivated by hoeing in the same manner as garden vegetables. Weeds should be promptly removed, so that they will not impair the growth of the young trees. Frequent cultivation should be continued throughout the summer, and will be beneficial if done oftener than is required merely to keep the weeds down. This is especially true if the weather is hot and dry.

WATERING THE SEEDLINGS.

If rains do not furnish enough moisture, the beds should be watered once or twice each week sufficiently to saturate the earth to a depth of at least 6 inches. A good way to apply water to the seed bed is by pouring it into shallow furrows hollowed out between the rows of seedlings and allowing it to stand in these channels until it soaks down. A mere sprinkling of water will avail nothing. Watering should be done promptly and regularly whenever the soil moisture begins to fail. In order to prevent rapid evaporation from the surface, it is best to water the beds in the early morning or toward sundown.

PROTECTION OF THE SEEDLINGS DURING THE WINTER.

Some protection is necessary, or at least beneficial, in wintering seedlings in their first season. In regions where the winters are mild and the ground freezes but slightly, it will be sufficient to "hill up" the earth against the rows to a depth of from 4 to 6 inches, care being taken not to bury the seedlings. Where the winters are severe, the trees should have, in addition to the banking with earth, a covering of straw, leaves, or moss from 6 inches to a foot in depth, held in place by branches or poles.

TRANSPLANTING THE SEEDLINGS TO THE NURSERY BED.**PREPARING NURSERY PLANTATION FOR SEEDLINGS.**

Broadleaf seedlings which are 1 year old, with the exception of a few slow-growing varieties such as the hackberry, are ready to be transplanted from the seed bed to a nursery plat or plantation, but they are hardly large and strong enough to be set out in isolated locations along the roadside or in the lawn. They still require cultivation, and should therefore be transplanted to some partially shaded field or nursery bed where they may still have care and yet have more room to grow (figs. 4 and 5). In order to dispose of them properly, the pupils may take them to their homes and set them out along the edge of the garden plats until they are large enough to transplant to permanent sites (fig. 6), or the school may set them out in a nursery plantation.

The pupils will probably derive more benefit if a school plantation is maintained. In order to provide for such a plantation, a portion of the ground available for nursery purposes should be set aside to receive the seedlings when they are 1 year old. The following year another crop will be ready, and a second plat should be set aside to receive these. This will continue until the first trees transplanted are large enough to bear setting out in the permanent locations selected for them, when they can be taken up and removed from the nursery bed. Then the rotation can be begun anew, using the ground rendered available by the removal of the first crop of seedlings for the new crop of yearling trees. Such a plantation will keep the trees where they can most easily be cared for by the school, and the visible results of the work done will be more impressive because the trees will all be together in one place.

TIME FOR TRANSPLANTING.

Spring is generally the best season of the year in which to transplant trees, but in warm regions, where the fall season changes slowly to winter, and the winters are mild, forest trees may be successfully transplanted in the fall, with the advantage that the root growth

which is obtained before the ground freezes will enable the tree to get an early start in the spring. In regions where the winters are severe, however, the seedlings are much safer if properly protected in the seed bed until spring. The transplanting should be done as early in the spring as the ground can be worked.

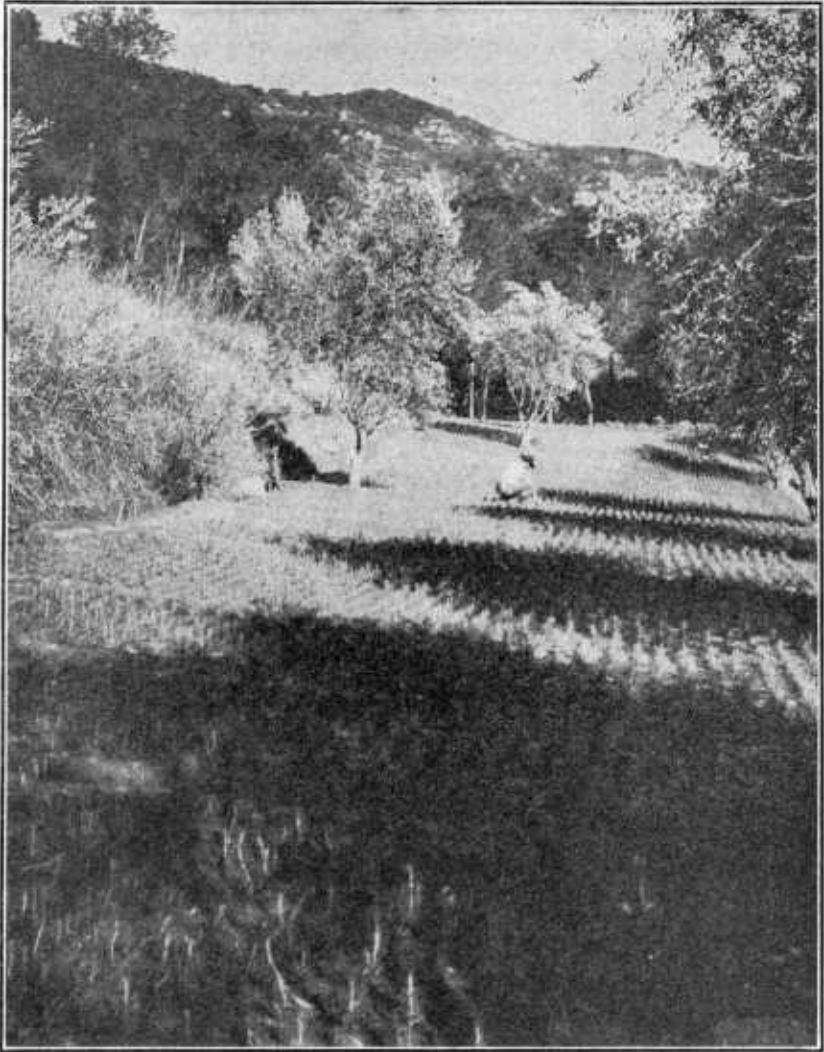


FIG. 4.—A nursery bed should be situated where the seedlings will be partially shaded, as on the north or east side of a group of buildings or trees.

TAKING UP THE SEEDLINGS.

Success in transplanting seedlings will depend largely upon the care with which they are taken from the seed bed. The best method

is to sink a spade deep into the soil 5 or 6 inches to one side of the young trees, pry upward with the spade until the earth about the seedlings is thoroughly loosened, grasp them by the stems close to the ground, and gently raise them from the soil.

PRUNING THE ROOTS AND TOPS.

If a seedling has a large taproot, about one-third of this should be removed. If there is no taproot, but the tree has very large, spreading side roots, these too will need shortening. Any long, straggling, or broken roots should always be trimmed off.

The top of the seedling should also be trimmed back until it is approximately the same size as the root system. Unless this is done, the roots will not be able to supply food enough for the crown.

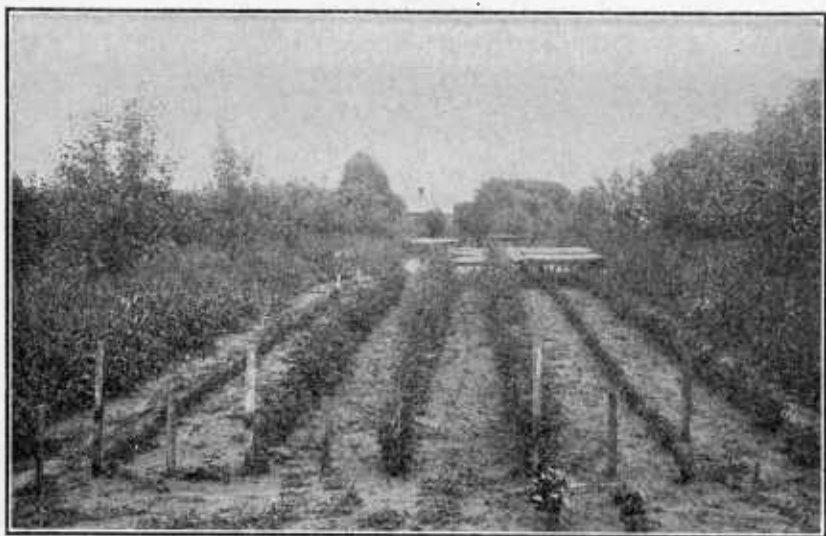


FIG. 5.—A small nursery of broad-leaf trees suitable for school. Rows $2\frac{1}{2}$ feet apart. Each row contains a single species, as indicated by the label on stake at end of row.

WRAPPING AND PACKING.

Uprooted seedlings suffer more or less when exposed to the wind and sun if only for a few moments, so great care must be taken to protect them. Sunny and windy weather should be avoided when transplanting trees, and the seedlings taken up only on cloudy, damp days. As they are lifted from the soil they should be laid in piles, roots together, and the roots immediately covered with a few shovelfuls of moist earth until they can be wrapped in wet burlap or coarse cloth of some sort. If they are to be sent any distance the roots of the trees should be carefully packed in damp moss or chaff, and the whole securely wrapped with the burlap.

PLANTING THE SEEDLINGS IN THE NURSERY BED.

The ground in which the seedlings are to be set out temporarily until large enough for planting along roadsides or in lawns should be prepared in the same manner as described for the preparation of the seedbed. It should be mellow and free from grass and weeds so as to be easily cultivated. The trees should be set out in rows about 2 feet 6 inches apart, and spaced from 6 inches to 1 foot in the rows, so as to allow of easy cultivation. As a general rule, they should be set in the earth about 2 or 3 inches deeper than they originally stood. They may be set in a trench, or in holes dug for each tree. The roots should be extended in their natural positions and the dirt packed closely about them, but not tamped so solidly as to prevent the air from penetrating.

Watering the tree when it is transplanted is seldom necessary. It is best not to pour water into the hole upon the exposed roots of



FIG. 6.—The pupils may take the young trees home and set them out along the edge of the garden until large enough to be set out in permanent sites.

the tree. If the soil is very dry, the hole should be dug some time beforehand and filled with water. This should be allowed to soak into the soil before the tree is planted. When the hole is filled in, leave a layer 2 or 3 inches deep of loose, fine dirt on top. This will act as a mulch to conserve the moisture below.

CULTIVATION OF THE NURSERY BED.

The trees transplanted to the nursery beds should be cultivated frequently, but not by deep plowing or spading, which would injure the roots. The weeds must be kept down and the ground kept loosened to a depth of 2 or 3 inches (fig. 7). The care of the nursery stock is in every way similar to that of the seedlings in the seed bed.

FINAL DISPOSAL OF YOUNG TREES.

PLANTING ON SCHOOL GROUNDS.

The final disposal of the trees grown in the school nursery is a matter of much importance. The success of the whole undertaking will depend largely upon how many strong, desirable trees can be saved and planted in permanent sites where they will benefit the school or the community.

Naturally, the first location which suggests itself as a suitable planting site is the school ground itself. Many school sites are without trees of any sort. Others are filled with trees of undesirable species which can be replaced by better ones. Almost without exception school sites can be improved by judicious tree planting.

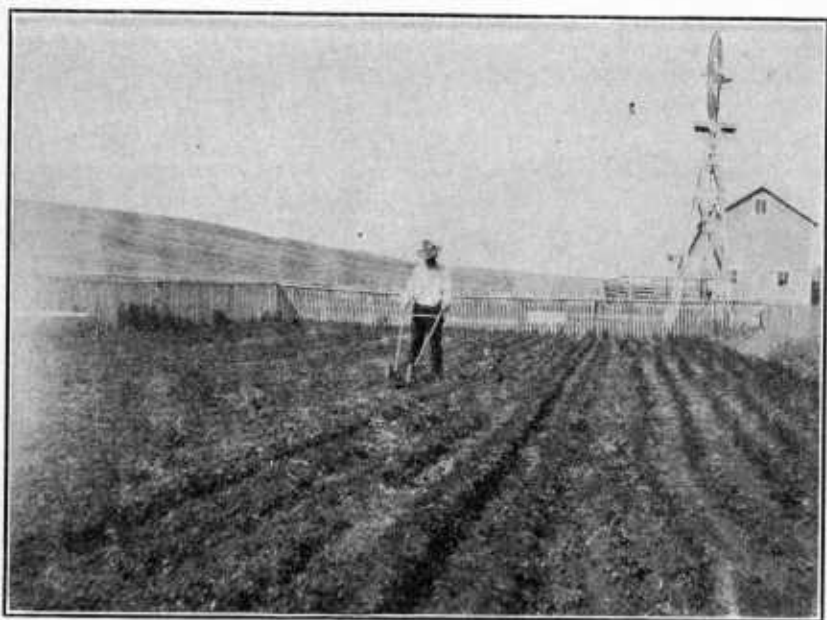


FIG. 7.—The trees in the nursery should be cultivated frequently to keep down the weeds and loosen the soil.

Before beginning to set out the trees a detailed planting plan should be prepared. This should show the locations of the buildings and features of the school ground which will affect planting, and should show specifically where the trees are to be planted. This plan should provide a definite scheme to be followed in the decoration and protection of the grounds and should be carefully worked out and as carefully observed. No specific directions for such a plan can be given here, but the following general rules should be observed:

(1) Sufficient space should be first of all set aside for a playground and no trees planted where they will interfere with this. A very

desirable feature is to provide an open lawn directly in front of the building.

(2) Group the trees in masses as much as possible instead of scattering them singly. This will give a better effect in beautifying the grounds and afford better shelter.

(3) Avoid planting the trees in straight, formal rows. Plant in irregular groups, or along curved lines as much as possible. A shelter belt along the rear and possibly the sides of the grounds is desirable, especially along the north side, or the sides from which the most storms come.

Further directions for planting trees on school grounds will be found in Farmers' Bulletin 134. This may be had free upon application to the United States Department of Agriculture, Washington, D. C.

DISTRIBUTION AMONG PUPILS FOR HOME PLANTING.

It is probable that if the trees grow well in the nursery and are of desirable species, there will be a demand for them on the part of the children or their parents for planting about their homes. As elsewhere suggested, especially desirable young trees of new or rare species may be awarded as prizes to those pupils who have shown the greatest interest in the nursery or have been most faithful in their work. The awarding of these prize trees might well form a very appropriate exercise for an Arbor Day program. When trees are to be taken to the homes of the pupils, special care must be taken to see that they are properly wrapped and packed, and the roots kept moist until transported to the final destination. Pupils should be instructed to plant the trees as soon as they are unwrapped.

MAKING A SCHOOL WOODLOT OR FOREST PLANTATION.

In some localities it will be possible for the school to perform a service to the community and at the same time put into practice one of the most important lessons of forestry by using the nursery trees to reforest some tract of land from which the timber has been cut, or to establish a practical woodlot on some piece of unused land. Very frequently there will be found in the vicinity of the school hillsides which are badly eroded, and the owners would be only too glad to have this erosion checked by the planting of forest trees on the slopes (fig. 8). Possibly a small field or lot which has been sown to ordinary farm crops so long that the soil is worn out will be available. Trees will grow well in such soil. Perhaps a small point of land, cut off from cultivation by streams or deep ditches, can be found; or some farm owner of the neighborhood will want to start a woodlot or plant a shelter belt on his place. In any of these cases the practice of actual forestry afforded by this means of disposing of the trees gives one of the best possible solutions of the problem. The results will be self-evident and hence will be the source of much

pleasure and pride to the school. Another advantage is that small seedlings, one or two years old, may be used for establishing forest plantations of this kind, whereas larger trees are preferable for planting for shade or ornament.

It will be extremely desirable, if the school has opportunity to establish a plantation of the sort mentioned in the preceding paragraph, to secure expert advice as to the best methods of planting and caring for the trees. In many States there are state foresters or forestry commissions from which this advice may be had free; but in case there is no help to be had from this source, application should be

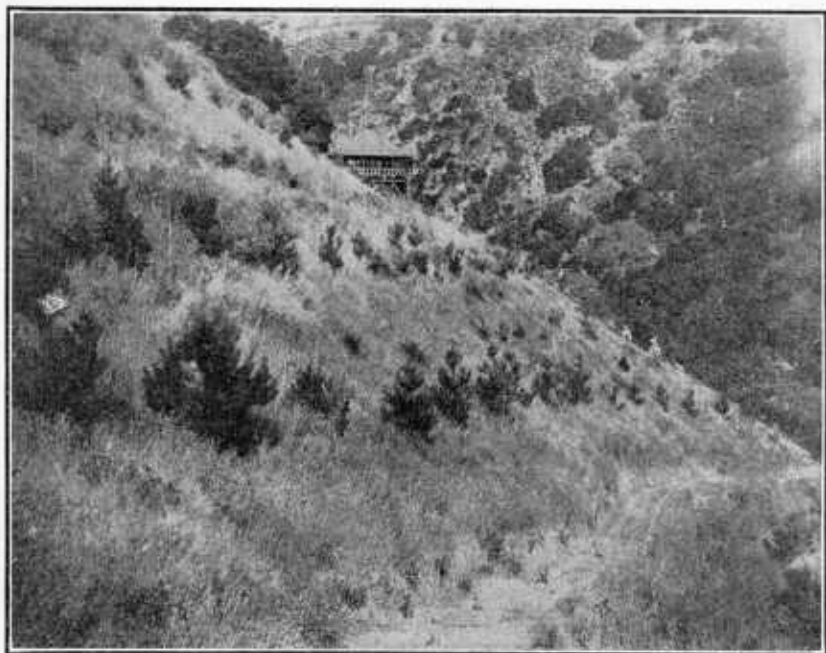


FIG. 8.—The trees may be set out on some barren hillside or plat of waste land.

made direct to the Forest Service of the United States Department of Agriculture, Washington, D. C. The desired assistance will be afforded, either through the nearest district office or directly from the Washington office.

SALE OF NURSERY STOCK.

Young forest trees, suitable for planting in woodlots or forests, can frequently be sold for good prices. Cities and towns may want them for street and park planting; or the farmers of the vicinity may purchase them for planting about their homes. It will frequently be possible for the school which has had reasonable success with its nursery to sell the trees and derive considerable profit from this source. If there is a commercial nursery in the vicinity the stock

of trees may be sold to it. This method of disposing of the trees will not give the satisfaction resulting from seeing the trees grow to maturity in the woodlot or school grounds, but most schools can make good use of any funds derived from the sale of the trees.

FIELD SOWING.

Trees like the oaks and hickories, which have long, thick taproots and few fibrous roots, are difficult to transplant. It is therefore advisable, where possible, to plant the acorns or nuts in the place where they are intended to remain permanently. The proper way to plant them in this case will depend somewhat on local conditions and the results desired. In general the seeds or nuts should be planted in holes or shallow furrows at whatever distance apart it is desired to have the trees. Three or four nuts should be placed in each hole, since mice and squirrels are likely to destroy some of them and some of the nuts may fail to germinate even if undisturbed. The rows should be straight in at least one direction for cultivation. If possible the plantation should be cultivated regularly until the trees are large enough to shade the ground. Stock should be kept away from the young trees so that they will not be destroyed by the grazing animals.

GROWING TREES FROM CUTTINGS.

The seeds of such trees as the willow, cottonwood, and poplars are comparatively difficult to collect and soon lose their vitality. On the other hand these trees grow readily from cuttings made from branches and sprouts. It would therefore be neither necessary nor desirable to attempt to produce these trees from seeds. They may be much more quickly and successfully grown from cuttings.

Some time in February or March, just before the spring growth begins, cuttings about 10 inches long should be made from strong, healthy, smooth branches or sprouts of the previous season's growth, from one-fourth to three-fourths of an inch in diameter. Cut the twigs off square at both ends with a sharp hatchet, and make the upper cut just above a bud. To prevent the cuttings from drying out they may be tied in bundles, tops all in one direction, and the bundles buried in moist sand or earth until wanted for planting. Freezing will not injure them.

In the spring when the ground is ready for planting it should be prepared the same as for the seed bed. The cuttings should be set with a spade or in a furrow, or if the ground is mellow they may be merely thrust into the soil until but one bud remains above the surface. Better contact with the soil will be secured if they are set somewhat slanting; the growth will be erect in any case. The soil should be firmly packed about the cutting with the foot or a tamping block. The care and cultivation of cuttings should be the same as for seedlings.

Nursery planting table for forest trees.

No.	Species.	When to collect seeds.	How to store seeds.	Per cent which should germinate.	When to plant seeds.	Depth to plant seeds.	Spacing of seeds in rows.	Height of 1-year old seedlings.	Forest Service publication for reference.
1	Ash, Green.	October.	Bury in sand.	35-50	Spring.	Inches.	Scatter thickly.	Inches.	Circular 92.
2	Ash, White.	do.	do.	35-50	do.	do.	do.	6-9	Circular 84.
3	Basswood.	September or October.	Sow at once.	5-50	Fall.	do.	do.	6-10	Circular 63.
4	Beech.	Fall.	Bury in sand.	70-80	Early spring.	do.	2 inches apart.	3-6	
5	Butternut ^a .	September or October.	do.	75-80	do.	do.	3 to 6 inches apart.	10-18	
6	Boxelder.	do.	do.	40-60	Spring.	do.	Touching in rows.	10-14	Circular 86.
7	Catalpa, Hardy.	October or November.	Cool, dry place.	40-75	do.	do.	do.	14-30	Circular 82.
8	Cherry, Black.	August or September.	Bury in sand.	75-80	do.	do.	2 to 3 inches apart.	4-6	Circular 94.
9	Coffeetree, Kentucky.	September or October.	Cool, dry place, or bury in sand.	70-75	do.	do.	do.	3-6	Circular 91.
10	Cottonwood ^b .	June or July.	Sow at once.	75-95	Summer.	do.	1 inch apart.	20-30	Circular 77.
11	Elm, Slippery.	May or June.	do.	50-75	Late spring.	do.	Scatter thickly.	15-18	Circular 85.
12	Elm, White.	do.	do.	50-75	do.	do.	do.	5-10	Circular 66.
13	Hackberry.	October.	Bury in sand.	70-80	Spring.	do.	1 to 2 inches apart.	6-12	Circular 75.
14	Hickory, Pignut ^a .	September or October.	do.	50-75	do.	do.	3 to 6 inches apart.	2-6	Sylva leaf let 48.
15	Hickory, Shagbark ^a .	do.	do.	50-75	do.	do.	do.	2-6	Circular 62.
16	Hickory, Shellbark.	do.	do.	50-75	do.	do.	do.	2-6	Sylva leaf let 50.
17	Locust, Black.	October.	Cool, dry place, or bury in sand.	50-75	do.	do.	2 to 3 inches apart.	18-20	Circular 64.
18	Locust, Honey.	do.	do.	50-75	Fall or spring.	do.	do.	6-14	Circular 74.
19	Maple, Red.	May or June.	Sow at once.	25-60	Late spring.	do.	do.	6-10	
20	Maple, Silver.	do.	do.	25-50	do.	do.	1/2 inch apart.	12-20	
21	Maple, Sugar.	October.	do.	30-50	Fall or spring.	do.	do.	6-12	Circular 76.
22	Malberry, Russian.	July or August.	Sow at once or bury in sand.	75-95	Spring.	do.	Scatter thickly.	8-10	Circular 93.
23	Oak, Bur ^a .	September or October.	Cool, dry place.	75-95	Fall or spring.	do.	3 to 6 inches apart.	5-9	Circular 86.
24	Oak, Red ^a .	do.	do.	75-95	do.	do.	do.	6-20	Circular 56.
25	Oak, White ^a .	do.	do.	75-95	do.	do.	do.	5-9	Circular 58.
26	Osage Orange.	do.	Cool, dry place.	60-95	Spring.	do.	1 inch apart.	10-15	Circular 106.
27	Poplar, Yellow.	do.	Sow at once.	5-10	Fall.	do.	Scatter thickly.	4-6	Circular 90.
28	Walnut, Black ^a .	do.	Bury in sand.	75-80	Spring.	do.	3 to 6 inches apart.	10-18	Circular 93.

^a Difficult to transplant on account of tap root. Advisable to sow seeds in permanent sites in field whenever possible.^b Easily grown from cuttings. Not necessary or advisable to attempt growing from seed.